Chapter 8 · Journey Inside the Atom

PLAY & LEARN

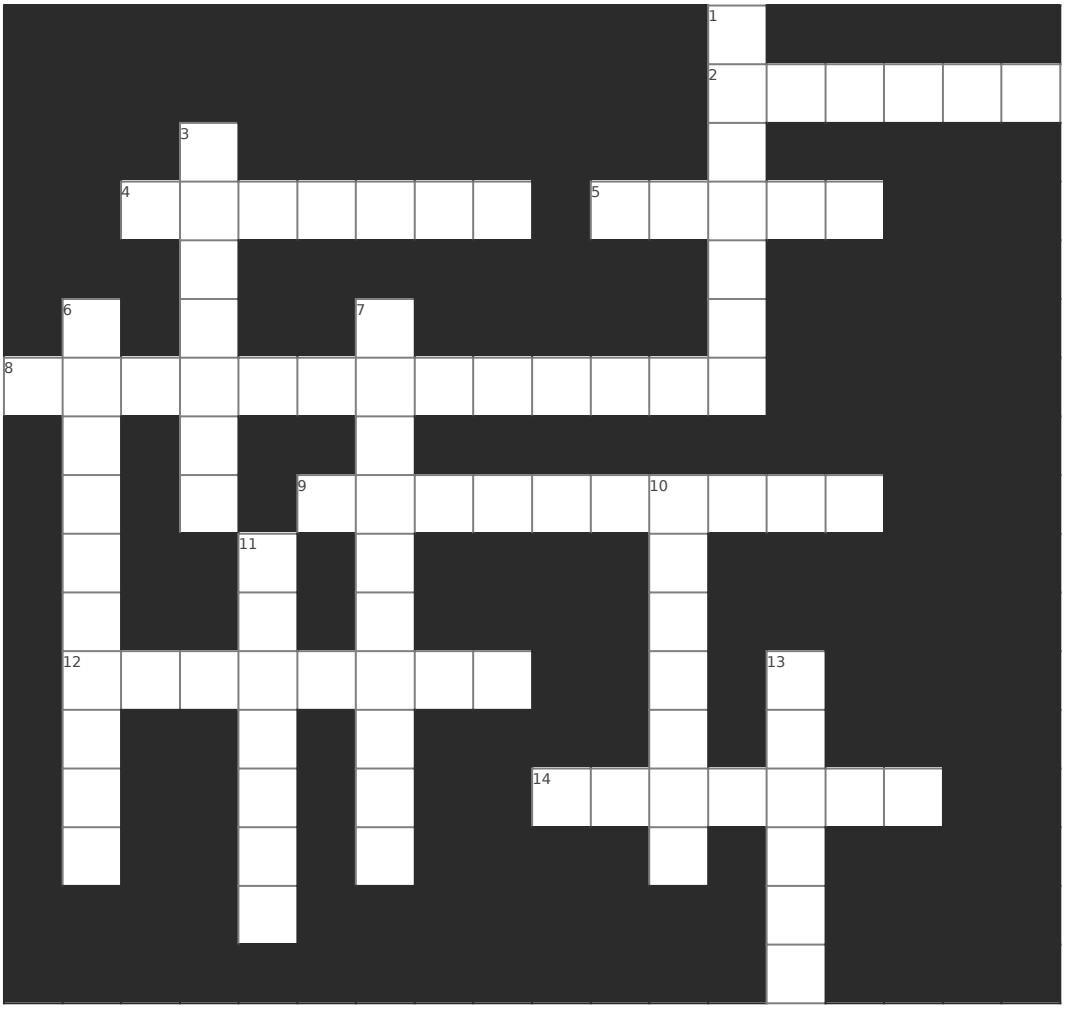
A puzzle workbook — crosswords, word searches, scrambles and quiz games

Print it. Solve it. Race a friend. Answer keys are at the back — no peeking.

#	Puzzle	Play it	Time
1	The Crossword	Solo or pairs	15 min
2	Word Search	Solo — race the clock	10 min
3	Scrambled Terms	Solo	8 min
4	Odd One Out	Teams of 4	10 min
5	Chapter Scrabble	Groups of 3–4	20 min
6	Who Am I? — Clue Cards	Whole class	15 min
7	True or False Sprint	Whole class, standing	6 min
8	Bingo	Whole class	15 min
9	Two Truths and a Lie	Pairs	10 min
10	The Escape Challenge	Teams of 4	25 min

Puzzle 1 · The Crossword

Every answer is a word from this chapter. Fill the white squares — one letter per square.



ACROSS

2. ____ number — the count of protons in a nucleus (6)

4. a radioactive isotope of hydrogen with two neutrons (7)

5. an energy level in which electrons orbit (5)

8. spontaneous emission of radiation from unstable nuclei (13)

9. Bohr's ____ states — fixed orbits where electrons do not radiate energy (10)

12. a negatively charged particle orbiting the nucleus (8)

14. atoms of the same element with different neutron numbers (7)

DOWN

1. the combining capacity of an atom (7)

3. the simplest isotope of hydrogen, with no neutrons (7)

6. nickname for Thomson's plum-pudding style model (10)

7. Rutherford's alpha-particle ____ experiment (10)

10. an uncharged particle in the nucleus (7)

11. the dense, positively charged centre of an atom (7)

13. a positively charged particle in the nucleus (6)

Puzzle 2 · Word Search

16 terms are hiding in the grid — across, down, diagonally, and backwards. Circle each one, then tick it off the list. Beat 10 minutes and you win.

N	R	J	A	B	X	Y	H	S	U	E	L	C	U	N
O	F	W	P	T	U	X	X	D	S	E	J	V	V	R
R	P	X	A	N	O	S	M	O	H	T	O	P	E	U
T	B	O	H	R	H	M	A	G	S	H	E	L	L	T
C	V	V	N	F	W	N	O	R	T	U	E	N	F	H
E	L	A	N	Q	Y	Q	P	J	S	F	X	F	N	E
L	Q	S	L	R	U	H	Z	A	S	W	I	A	O	R
E	T	W	P	E	J	G	L	S	A	D	Z	U	C	F
H	I	P	M	V	N	F	M	T	M	A	R	M	I	O
H	B	R	M	Y	V	C	S	O	D	I	U	M	L	R
P	R	O	Z	F	A	I	Y	I	O	V	I	Y	I	D
H	O	T	C	T	I	O	D	J	D	W	Z	W	S	G
Y	U	O	L	H	R	M	V	Q	E	O	B	K	F	Y
H	U	N	C	P	I	S	O	T	O	P	E	R	O	X
A	T	H	Q	R	Q	R	E	G	R	A	H	C	P	D

☐ RUTHERFORD	☐ ELECTRON	☐ NUCLEUS
☐ NEUTRON	☐ ISOTOPE	☐ VALENCY
☐ THOMSON	☐ SILICON	☐ PROTON
☐ CHARGE	☐ SODIUM	☐ SHELL
☐ ORBIT	☐ BOHR	☐ ATOM
☐ MASS		

Race Rules

- **Solo:** find all the words. Note your time at the top of the page.
- **Pairs:** one partner finds across-and-down words, the other finds diagonals. First pair to complete the list wins.
- **Hard mode:** cover the word list. Find as many chapter terms as you can in 5 minutes.
- **Champion move:** for every word you find, say what it means out loud. No meaning, no point.

Puzzle 3 · Scrambled Terms

Every row is a chapter word with its letters shuffled. Unscramble it. The clue in brackets is your lifeline — try to solve without it first.

#	Scrambled letters	Clue	Your answer
1	I Y O R D I T A V A T C I	(spontaneous emission of radiation from unstable nuclei)	_____
2	C T G T I A R N S E	(Rutherford's alpha-particle ____ experiment)	_____
3	I R N A T A O S T Y	(Bohr's ____ states, where electrons do not lose energy)	_____
4	T E I P S O O	(same element, different number of neutrons)	_____
5	A E N E C V L	(____ shell — the outermost electron shell)	_____
6	A T A R L P Y E N	(Rutherford's ____ model of the atom)	_____
7	C O A T M B U S I	(particles smaller than the atom, like protons and electrons)	_____
8	R A E N L C U	(____ charge — the positive charge concentrated in the nucleus)	_____

Make It a Game

Beat the Bell: the teacher sets a 60-second timer. Every unscrambled word inside the bell = 1 point; a word you can also *define* = 3 points.

Chain Scramble: in a circle, each student scrambles a chapter word for the person on their left. Miss it and you are out. Last student standing wins.

Puzzle 4 · Odd One Out

Three belong together. One does not. Circle the odd one — then write why in one line. The "why" is where the marks are.

#	Which is the odd one out?	Because…
1	Proton · Neutron · Electron · Molecule	_____
2	Thomson · Rutherford · Bohr · Tyndall	_____
3	Protium · Deuterium · Tritium · Helium	_____
4	Positive · Negative · Neutral · Purple (charge types)	_____
5	Shell · Orbit · Valency · Sublimation	_____
6	Watermelon model · Plum pudding model · Planetary model · Solar panel	_____

Puzzle 5 · Chapter Scrabble

Play in groups of 3–4. You have one shared rack of letter tiles. Build only terms from this chapter — no ordinary English words allowed.

Your tile rack — cut these out or write them on paper squares:

A 1	**B** 3	**C** 3	**D** 2	**E** 1	**G** 2	**H** 4
I 1	**L** 1	**M** 3	**N** 1	**O** 1	**P** 3	**R** 1
S 1	**T** 1	**U** 1	**V** 4	**X** 8	**Y** 4	**Z** 10

Scoring:

You did this	Points
Each letter tile used	Its tile value
Word is a term from this chapter	× 2
Word is 8 letters or longer	+ 10 bonus
You can state its meaning correctly	+ 5
You can connect it to a real-life example	+ 3
Word is *not* in this chapter (challenged and lost)	− 5

How a Round Works

1. Player builds a word from the rack and lays it down.
2. Any opponent may **challenge** within 10 seconds: "That's not in this chapter."
3. Open the textbook. If the challenger is right, the word is removed and the builder loses 5 points. If the challenger is wrong, the *challenger* loses 5 points.
4. Builder states the meaning to claim the +5 bonus. The group votes on whether it was correct.
5. Play 6 rounds. Highest total wins.

Target Words (worth the most — do not show your opponents)

RADIOACTIVITY · STATIONARY · SCATTERING · SUBATOMIC · ISOTOPE · VALENCY · NUCLEUS · PLANETARY

Puzzle 6 · Who Am I? — Clue Cards

Cut along the lines. One student draws a card and reads only the first clue aloud; the class guesses. Wrong guess? Read clue 2. Fewer clues used = more points.

CARD 1 ① I am the dense centre of an atom. ② I hold protons and neutrons. ③ I am the nucleus.	**CARD 2** ① I carry a positive charge. ② I live inside the nucleus. ③ I am a proton.
CARD 3 ① I carry no charge at all. ② I also live inside the nucleus. ③ I am a neutron.	**CARD 4** ① I carry a negative charge. ② I orbit the nucleus in shells. ③ I am an electron.
CARD 5 ① I fired alpha particles at gold foil. ② Most passed through, but a few bounced back, revealing the nucleus. ③ I am Ernest Rutherford.	**CARD 6** ① I proposed that electrons occupy fixed orbits without losing energy. ② My orbits are called stationary states. ③ I am Niels Bohr.
CARD 7 ① I proposed a positively charged sphere with embedded electrons. ② My model is nicknamed watermelon or plum pudding. ③ I am J.J. Thomson.	**CARD 8** ① I am an atom of the same element with a different number of neutrons. ② Protium, deuterium and tritium are examples of me applied to hydrogen. ③ I am an isotope.
CARD 9 ① I am the combining capacity of an atom. ② Sodium has one of me; oxygen has two. ③ I am valency.	**CARD 10** ① I am an energy level electrons occupy. ② K, L, M and N are examples of me. ③ I am a shell.
CARD 11 ① I am the spontaneous emission of radiation from unstable nuclei. ② I was central to a whole new field of physics. ③ I am radioactivity.	

Scoring: guessed after clue ① = **5 points** · after ② = **3 points** · after ③ = **1 point**

Puzzle 7 · True or False Sprint

Everyone stands. Teacher reads a statement. True → stay standing. False → sit down. Get it wrong and you are out. Last student standing wins.

#	Statement	Your call
1	The nucleus is negatively charged.	☐ True ☐ False
2	Protons and neutrons are both found in the nucleus.	☐ True ☐ False
3	Electrons orbit the nucleus in shells.	☐ True ☐ False
4	Rutherford's gold-foil experiment led to the discovery of the nucleus.	☐ True ☐ False
5	Bohr proposed that electrons lose energy continuously while orbiting.	☐ True ☐ False
6	Isotopes of an element have the same number of protons.	☐ True ☐ False
7	Isotopes of an element always have the same number of neutrons.	☐ True ☐ False
8	Valency describes an atom's combining capacity.	☐ True ☐ False
9	Thomson's model is nicknamed the "watermelon" or "plum pudding" model.	☐ True ☐ False
10	Radioactivity is the spontaneous emission of radiation from unstable nuclei.	☐ True ☐ False
11	Protium has one neutron.	☐ True ☐ False
12	The atomic number equals the number of protons.	☐ True ☐ False
13	An electron has more mass than a proton.	☐ True ☐ False
14	Most of an atom's mass is concentrated in the nucleus.	☐ True ☐ False

Puzzle 8 · Bingo

Each student fills the empty grid below with any 16 words from the word bank — in any order, one per box. The teacher then reads out meanings, not names. Cross a box only when its meaning is called. First to a full row, column or diagonal shouts BINGO.

Word bank — choose any 16:

Nucleus	Proton	Neutron	Electron
Isotope	Valency	Shell	Radioactivity
Rutherford	Thomson	Bohr	Protium
Tritium	Stationary states	Atomic number	Scattering

Your bingo card:

Caller’s List (teacher only — read the meaning, never the name)

① "I am the dense, positively charged centre of an atom." ② "I am a positively charged particle in the nucleus." ③ "I am an uncharged particle in the nucleus." ④ "I am a negatively charged particle orbiting the nucleus." ⑤ "I am an atom of the same element with a different neutron count." ⑥ "I am the combining capacity of an atom." ⑦ "I am an energy level electrons occupy." ⑧ "I am the spontaneous emission of radiation from unstable nuclei." ⑨ "I fired alpha particles at gold foil." ⑩ "I proposed fixed orbits where electrons do not radiate energy." □ "I proposed a positively charged sphere with embedded electrons." □ "I am the simplest isotope of hydrogen, with no neutrons."

Puzzle 9 · Two Truths and a Lie

Each set has three statements. Two are true, one is a lie. Circle the lie — and correct it in one line.

Set 1

(a) Protons are positive.
(b) Neutrons are positive.
(c) Electrons are negative.

The lie is _____ . Corrected: _____

Set 2

(a) Rutherford discovered the nucleus.
(b) Thomson proposed the plum-pudding model.
(c) Bohr discovered the electron.

The lie is _____ . Corrected: _____

Set 3

(a) Isotopes have the same number of protons.
(b) Isotopes have the same number of neutrons.
(c) Isotopes are atoms of the same element.

The lie is _____ . Corrected: _____

Set 4

(a) The nucleus contains protons and neutrons.
(b) The nucleus contains electrons too.
(c) The nucleus is positively charged overall.

The lie is _____ . Corrected: _____

Puzzle 10 · The Escape Challenge

Solve all five gates. Each gives you one digit. Collect all five to unlock the exit code.

🔒 GATE 1 — The Particle Gate

How many types of subatomic particles are covered in this chapter (proton, neutron, electron)? Use that number.

Digit: ☐

🔒 GATE 2 — The Isotope Gate

Protium has 0 neutrons, deuterium has 1, tritium has 2. Use the tritium number.

Digit: ☐

🔒 GATE 3 — The Model Gate

How many atomic models are named in this chapter (Thomson, Rutherford, Bohr)? Use that number.

Digit: ☐

🔒 GATE 4 — The Shell Gate

Count the letters in SHELL.

Digit: ☐

🔒 GATE 5 — The Charge Gate

How many types of electric charge exist (positive, negative, neutral)? Use that number.

Digit: ☐

EXIT CODE: ☐ ☐ ☐ ☐ ☐

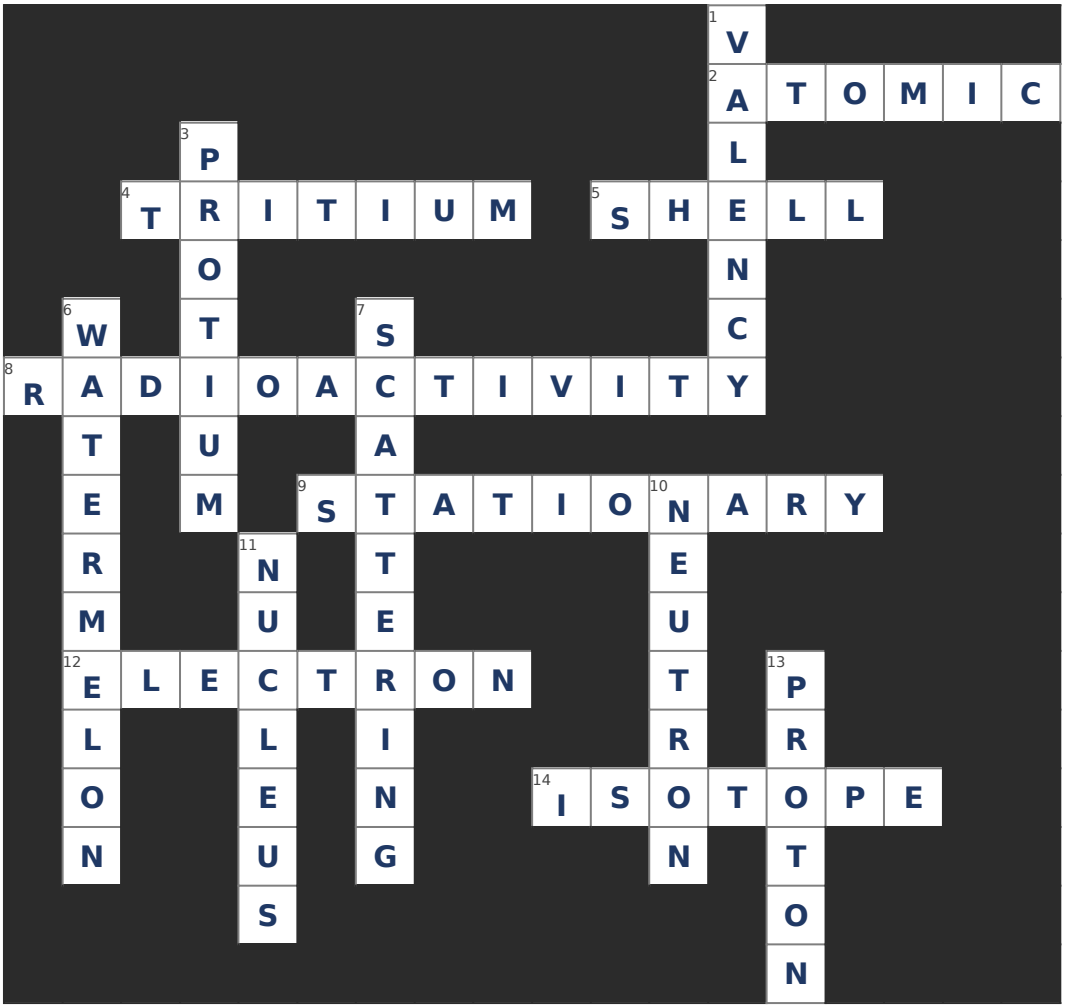
🔒 Teacher's note

Hide the gate cards around the classroom. Teams rotate every 4 minutes. First team to reach the door with the correct code escapes. Losing teams try again next period.

Answer Keys

Teachers and self-checkers only. Solve first — the puzzle is the point.

Puzzle 1 · Crossword — Solved Grid



Across: 2 ATOMIC · 4 TRITIUM · 5 SHELL · 8 RADIOACTIVITY · 9 STATIONARY · 12 ELECTRON · 14 ISOTOPE

Down: 1 VALENCY · 3 PROTIUM · 6 WATERMELON · 7 SCATTERING · 10 NEUTRON · 11 NUCLEUS · 13 PROTON

Puzzle 2 · Word Search — Solved Grid

N	R	J	**A**	B	X	Y	H	**S**	**U**	**E**	**L**	**C**	**U**	**N**
O	F	W	P	**T**	U	X	X	D	S	E	J	V	V	**R**
R	P	X	A	**N**	**O**	**S**	**M**	**O**	**H**	**T**	O	P	E	**U**
T	**B**	**O**	**H**	**R**	H	**M**	A	G	**S**	**H**	**E**	**L**	**L**	**T**
C	**V**	V	N	F	W	**N**	**O**	**R**	**T**	**U**	**E**	**N**	F	**H**
E	L	**A**	N	Q	Y	Q	P	J	**S**	F	X	F	**N**	**E**

L	Q	S	**L**	R	U	H	Z	A	**S**	W	I	A	**O**	**R**
E	**T**	W	P	**E**	J	G	L	S	**A**	D	Z	U	**C**	**F**
H	**I**	**P**	M	V	**N**	F	M	T	**M**	A	R	M	**I**	**O**
H	**B**	**R**	M	Y	V	**C**	**S**	**O**	**D**	**I**	**U**	**M**	**L**	**R**
P	**R**	**O**	Z	F	A	I	**Y**	I	O	V	I	Y	**I**	**D**
H	**O**	**T**	C	T	I	O	D	J	D	W	Z	W	**S**	G
Y	U	**O**	L	H	R	M	V	Q	E	O	B	K	F	Y
H	U	**N**	C	P	**I**	**S**	**O**	**T**	**O**	**P**	**E**	R	O	X
A	T	H	Q	R	Q	R	**E**	**G**	**R**	**A**	**H**	**C**	P	D

Puzzle 3 · Scrambled Terms

1. RADIOACTIVITY · 2. SCATTERING · 3. STATIONARY · 4. ISOTOPE · 5. VALENCE · 6. PLANETARY · 7. SUBATOMIC · 8. NUCLEAR

Puzzle 4 · Odd One Out

#	Odd one	Because
1	Molecule	proton, neutron and electron are subatomic particles; a molecule is made of atoms, not smaller than one
2	Tyndall	the other three proposed atomic models; Tyndall belongs to Chapter 5 (colloids)
3	Helium	protium, deuterium and tritium are all isotopes of hydrogen; helium is a different element
4	Purple	positive, negative and neutral are the three types of electric charge; purple is a colour
5	Sublimation	shell, orbit and valency are all atomic-structure terms; sublimation is a Chapter 5 change of state
6	Solar panel	the other three are historical models of atomic structure; a solar panel is unrelated

Puzzle 7 · True or False Sprint

1-F · 2-T · 3-T · 4-T · 5-F · 6-T · 7-F · 8-T · 9-T · 10-T · 11-F · 12-T · 13-F · 14-T

Puzzle 9 · Two Truths and a Lie

Set	The lie	Correction
1	b	Neutrons carry no charge at all — they are neutral, not positive.
2	c	J.J. Thomson discovered the electron; Bohr proposed the stationary-states model.
3	b	Isotopes differ in their number of neutrons — that is the whole point.
4	b	Electrons orbit outside the nucleus; they are not found inside it.

Puzzle 10 · The Escape Challenge

EXIT CODE: 3 · 2 · 3 · 5 · 3

(Answer: 3) (Answer: 2) (Answer: 3) (Answer: 5) (Answer: 3)

Now go sketch your own atom — protons, neutrons and electrons, correctly placed. ⚛